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(54) **SYSTEM AND METHOD FOR PRODUCING FOAMED AND STEAMED MILK FOR HOT BEVERAGES**

VORRICHTUNG UND VERFAHREN ZUR HERSTELLUNG VON MILCHSCHAUM FÜR HEISSE GETRÄNKE

SYSTEME ET PROCEDE DE PRODUCTION DE LAIT EN MOUSSE ET TRAITE A LA VAPEUR POUR BOISSONS CHAUDES

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## Description

**[0001]** The present invention relates generally to a beverage system and more particularly relates to systems and method for producing foamed and steamed milk for beverages.

**[0002]** Hot beverages such as cappuccinos and lattes are becoming increasingly popular. Commercial businesses from fast food restaurants to coffee houses are providing these hot beverages to their customers. Although hot beverages may be made in sufficient quantity for a high volume restaurant, many customers may prefer a freshly brewed beverage. Likewise, these customers also may prefer freshly made foamed or steamed milk in their hot beverage. The foamed or steamed milk generally is of higher quality if it is made fresh for each customer. However, current technology may not produce foamed or steamed milk quickly or efficiently enough to satisfy consumer demands.

**[0003]** Generally described, foamed milk may be produced using steam, milk, and air, whereas steamed milk is produced using only steam and milk. Specifically, steam, milk, and/or air may be forced through a single venturi orifice. The steam, milk, and/or air may then be mixed as they pass through the single venturi orifice. The milk, steam, and/or air, however, may not be sufficiently mixed. Insufficient mixing may introduce inefficiencies that result in some of the milk not being converted to foam. Furthermore, it may take a considerable amount of time to produce the foamed or steamed milk by forcing the steam, milk, and/or air through the single venturi orifice.

**[0004]** What may be desired, therefore, is a foamed or steamed milk dispenser that can produce foamed and steamed milk in an efficient, high quality, and high speed manner to individual consumers in individual servings. The device, however, preferably should be easy to use, easy to maintain, and be competitive in terms of cost.

**[0005]** DE 4445436 A discloses a foaming device comprising pipes which supply steam, air and milk. Preferably the air supply pipe feeds into the steam pipe and the steam and milk pipes join in a mixing area.

**[0006]** The present invention provides a foamed milk system for creating foamed milk from a source of milk, a source of air, and a source of steam, comprising:

- a milk inlet system for pressurizing the milk;
- an air inlet system for pressurizing the air;
- a mixing area to mix the pressurized milk, the pressurized air, and the steam; and
- an expansion area to expand the mixture of the pressurized milk, the pressurized air and the steam;

characterised in that said mixing area comprises an annular region formed between an inner wall of a hollow nozzle block and a nozzle insert positioned within the hollow nozzle block.

**[0007]** The milk inlet system may include a peristaltic

pump. A disposable hose may connect the peristaltic pump and the source of milk. The air inlet system may include an air pump. A hose connector may connect the milk inlet system and the air inlet system. The hose connector may include a three-way or a four-way valve. A disposable hose also may connect the hose connector and the mixing area.

**[0008]** The nozzle insert may include a number of protrusions positioned thereon and a number of orifice area positioned about the protrusions. The nozzle insert may be removable.

**[0009]** The foamed milk system further may include a diffuser to gather the flow of the foamed milk to be dispensed. The diffuser may include a diffuser insert and a spout.

**[0010]** The foamed milk system further may include a sanitation system. The sanitation system may include a source of hot water. The hot water flows through the mixing area and the expansion area via a sanitation hose.

**[0011]** A method of the present invention provides for producing foamed milk from milk, air, and steam. The method includes pressurizing the milk and the air, injecting the pressurized milk, the pressurized air, and the steam into a mixing area, and depressurizing the milk, air, and steam mixture to ambient pressure to create the foamed milk. The mixing area comprises an annular region formed between an inner wall of a hollow nozzle block and a nozzle insert positioned within a hollow nozzle block.

**[0012]** Preferred embodiments of the present invention will now be described by way of example only and with reference to the accompanying drawings in which:

Fig. 1 is a schematic view of the foamed milk system of the present invention.

Fig. 2 is a plan view of the mixing nozzle insert shown with the nozzle block in cross-section.

Fig. 3 is a perspective view of the nozzle insert and protrusions.

Fig. 4 is a perspective view of an alternative embodiment of a cleaning block junction.

**[0013]** Briefly described, the present invention injects pressurized milk, air, and steam into a mixing area of a nozzle body. The milk, air, and steam may be intimately and thoroughly mixed within one or more orifice areas. The mixture then proceeds to an expansion area where the mixture expands to ambient pressure. The expansion causes the milk to foam. The foamed milk may then be collected with a diffuser and dispensed into a cup. The present invention also can be used to produce steamed milk only by introducing steam and milk to the foamed milk system.

**[0014]** Referring now to the drawings in more detail, in which like numerals represent like elements throughout the several views, Figs. 1-3 show a foamed milk system 100 of the present invention. The foamed milk system 100 may include a pressurized milk inlet system 110. The

pressurized milk inlet system **110** may provide pressurized milk to the foamed milk system **100** as a whole. The pressurized milk inlet **110** system may include a milk supply **120**, a milk pump **130**, and a plurality of milk hoses **140**, **150**. The milk inlet system **110** may be positioned within a refrigerated container **155**. The refrigerated container **110** may be any type of standard refrigeration system. The milk supply **120** may include any type of container, including a carton, a bag in box, or any other type of storage device. The milk itself may be UHT (Ultra High Temperature) milk. The milk preferably is maintained at about 40 degrees Fahrenheit (4.4 degrees Celsius) or lower after opening. The milk preferably is replaced when the milk supply **120** is empty or about every 48 hours or so.

**[0015]** The milk hoses **140**, **150** may be made out of rubber, copper, stainless steel, other types of metals, plastics, and other types of substantially non-corrosive materials. The materials preferably are food grade. The hoses **140**, **150** preferably are disposable. Although any length may be used, the hoses **140**, **150** preferably are as short as possible to limit the length the milk must travel out of the milk supply.

**[0016]** The first milk hose **140** may connect the milk supply **120** to the milk pump **130**. The milk pump **130** may pressurize and meter the milk. The milk may be pressurized between about two (2) and about forty (40) pounds per square inch (psi) (about 0.14 to about 2.8 kilograms per square centimeter (ksc)) depending on the flow rate desired. The present embodiment may pressurize the milk to about fifteen (15) psi (about one (1) ksc). The milk pump **130** may be a peristaltic pump to better meter the milk. The peristaltic pump also may have the advantage of reducing the risk of backflow and, hence, reducing the risk of somehow contaminating the milk. Any other type of pump that pressurizes and meters the milk is contemplated for use herein.

**[0017]** The foamed milk system **100** also may include a pressurized air inlet system **160**. The pressurized air inlet system **160** may provide pressurized air to the foamed milk system **100**. The air may be pressurized to between about two (2) and about forty (40) psi (about 0.14 to about 2.8 ksc) using an air pump **170** depending on the desired flow rate. The present embodiment may pressurize the air to about fifteen (15) psi (about one (1) ksc). The air pump **170** may be any pump design that provides compressed air. The pressurized air may be delivered via an air hose **180**. The air hose **180** may include a microfilter **175** or a similar type of device to remove any impurities in the air stream.

**[0018]** The pressurized milk and the pressurized air may be combined and pre-mixed. The pressurized milk inlet system **110** and the pressurized air inlet system **160** may be joined at a hose connector **185** via the second milk hose **150** and the air hose **180**. The hose connector **185** may include three (3) hose fittings **190**, **200**, **210**. Any type of three (3) way valve may be used. The milk hose **150** may connected the output of the milk pump

**130** and the first hose fitting **190**. The air hose **180** may connect the output of the air pump **170** and the second hose fitting **200**. The pressurized air and pressurized milk may be combined into one stream in the hose connector **185** to allow the mixture to exit through the third hose fitting **210**.

**[0019]** As described above, the hose connector **185**, the milk hose **150**, and the air hose **180** may be made out of copper, stainless steel, other types of metals, plastics, rubber, and other types of substantially non-corrosive materials as described above. These elements may be detachable to allow for easier cleaning. The hose fittings **190**, **200**, **210** and the other connections described herein may be barbed and may include polished surfaces to prevent crevice accumulation. The hoses **150**, **180** preferably are disposable. The length of the hoses **150**, **180** preferably is as short as possible.

**[0020]** A mixture hose **220** may connect the hose connector **185** to a mixture inlet **230** of a nozzle body **240** to transport the milk and air mixture. The mixture hose **220** may be made out of copper, stainless steel, other types of metals, plastics, rubber, or other types of substantially non-corrosive materials as described above. The hose **220** preferably is disposable and as short in length as possible. The mixture hose **220** may be attached to the nozzle body **240** by fitting the mixture hose **220** into the mixture inlet **230**. Alternatively, a clamping mechanism or any other method to secure the mixture hose **220** in the mixture inlet **230** known in the art may be used.

**[0021]** The nozzle body **240** may be a substantially hollow block-like structure. The nozzle body **240** may be made out of stainless steel, aluminum, plastic, or any other substantially non-corrosive material. The nozzle body **240** may include an inner wall **250** and an outer wall **260**. The inner wall **250** may define a mixing area **310** as will be described in more detail below. The mixing area **310** may be substantially conical in shape.

**[0022]** The mixture inlet **230** may pass through the nozzle body **240** to the mixing area **310**. The mixture inlet **230** may be a hollow region in the nozzle body between the inner wall **250** and the outer wall **260** that allows the mixture hose **220** to fit into the nozzle body **240** and allows the milk and air mixture to pass to the mixing area **310**. The mixture inlet **230** also is contemplated to include an insert or any other means of allowing the mixture hose **220** to feed the mixture into the mixing area **310**. The mixture inlet **230** may include a barbed connector. The present invention is not limited to pre-mixing the pressurized air and milk prior to the mixing area **310**. It is contemplated that the milk and air may enter the mixing area **310** jointly or separately.

**[0023]** The foamed milk system **100** also may include a pressurized steam inlet system **235** that provides steam to the foamed milk system **310**. The steam inlet system **235** may include a steam generator **270**, a steam hose **280**, and a steam inlet **290**. The steam generator **270** may be a heat exchanger, a boiler, or any other device that creates pressurized steam. Steam in the present em-

bodiment may be pressurized to about forty (40) psi (about 2.8 ksc) or so. The pressure may be higher or lower depending on the rate of foam production required. The steam hose **280** may be used to transport the pressurized steam from the steam generator **270** to the steam inlet **290**. The steam hose **280** may be made out of copper, stainless steel, other types of metals, plastics, rubber, or other types of substantially non-corrosive materials as are described above. The steam hose **280** may be attached to the nozzle body **240** by fitting the steam hose **280** into the steam inlet **290** by a clamping mechanism or by any other method known in the art.

**[0024]** The steam inlet **290** may pass through the nozzle body **240**. The steam inlet **290** may be a hollow region in the nozzle body **240** between the inner wall **250** and the outer wall **260** that allows the steam hose **280** to fit into the nozzle body **240** and the steam to pass to the mixing area **310**. The steam inlet **290** may include a barbed connector. It is also contemplated that the pressurized steam may be pre-mixed with the pressurized milk and/or air prior to entering the mixing area **310**.

**[0025]** As described above, the inner wall **250** of the nozzle body may define the mixing area **310**. The inner wall **250** and the mixing area **310** may be tapered to allow a nozzle insert **300** to fit therein. The nozzle body **240** may be made of stainless steel, aluminum, plastic, or any other substantially non-corrosive material. The nozzle insert **300** may be tapered in a similar manner as the mixing area **310** so as to allow the insert **300** to fit inside of the nozzle body **240**. The nozzle insert **300** may be solid or hollow.

**[0026]** The nozzle insert **300** may be locked into the nozzle body **240** by using a twist lock mechanism, by a screwing mechanism, or by any other attachment means known in the art. The screwing mechanism, for instance, may include a screw attached to the top end of the nozzle insert **300** that screws into a threaded channel in the nozzle body **240**.

**[0027]** The insertion of the nozzle insert **300** may create an annular region between the inner wall **250** of the nozzle body **240** and the nozzle insert **300**. The annular region defines the mixing area **310** for the milk, air, and steam. In the mixing area **310**, the milk, air, and steam become intimately mixed so as to increase the efficiency of the system. As depicted in Figs. 2 and 3, the nozzle insert **300** also may contain a number of protrusions **320** to aid in the mixing of the milk, air, and steam. The protrusions **320** may contact the inner wall **250** of the nozzle body **240** when the nozzle insert **300** is placed inside the nozzle body **240**. The spaces between the protrusions **320** may create a number of orifice areas **330**. The use of the protrusions **320** in the mixing area **310** may promote turbulent fluid flow therein. This turbulent fluid flow may enhance mixing of the milk, air, and steam passing there through. However, turbulent flow is not required so long as sufficient mixing is achieved.

**[0028]** In an exemplary embodiment of the present invention, the nozzle body **240** may be about three (3) inch-

es (about 7.6 centimeters) long and substantially cylindrically shaped. The nozzle insert **300** also may be substantially cylindrically shaped and about one (1) inch (about 2.5 centimeters) long and about 0.6 inches (about 1.5 centimeters) in diameter at the base. The inner wall **250** of the nozzle body **240** and the nozzle insert **300** may be tapered at about a 10.5 degree angle. The nozzle insert **300** may only be tapered for about 0.8 inches (2 centimeters) of the length and the remaining length may not be tapered. The exemplary embodiment may include about two (2) rows of protrusions **320** with about sixteen (16) protrusions **320** per row within the mixing area **310**. The protrusions **320**, in the exemplary embodiment, may be about 0.029 inches (about 0.7 millimeters) tall and about 0.06 inches (1.5 millimeters) wide. The rows may be about one-third inch (about 0.85 centimeters) apart. Any number of protrusions **320**, rows of protrusions **320**, or size of protrusions **320** is contemplated so as to enhance the mixing of the milk, air, and steam. Further, the present invention is not limited to the dimensions in the exemplary embodiment. The nozzle body **240** and the nozzle insert **300** are contemplated to be any size and tapered at any angle that may create an adequate space for use with the present invention.

**[0029]** Adjacent to the mixing area **310** may be an expansion area **340**. The expansion area **340** may be located where the annular region between the inner wall **250** of the nozzle body and the nozzle insert **300** begins to widen or ends. The expansion area **340** may be at or about ambient pressure. As the pressurized milk, air, and steam mixture reach the expansion area **340** from the mixing area **310**, the mixture may begin to expand as the pressure of the mixture is reduced to about ambient pressure. This expansion may cause the milk, air, and steam mixture to foam as the pressure is reduced.

**[0030]** The foam then may be collected using a diffuser **350**. The diffuser **350** may be used to control and collect the foam from the expansion area **340** and dispense the foam into a cup or mug **380**. The diffuser **350** may include a diffuser insert **360** and a spout **370**. The diffuser insert **360** may be cylindrically shaped and may be tapered to funnel the foam to the spout **370**. The diffuser **350** may be made of stainless steel, aluminum, plastic, or any other substantially non-corrosive material. Any type of diffuser system is contemplated herein that allows the user to collect and dispense the foam into a cup or mug **380**.

**[0031]** The diffuser insert **360** and the bottom of the nozzle body **240** may be threaded so as to allow them to be screwed together. The diffuser insert **360** also may snap into the nozzle body **240** or be connected in any other means known in the art. The spout **370** may be threaded and screwed into the bottom of the diffuser insert **360**, snapped into the bottom portion of the diffuser insert **360**, or connected to the diffuser insert **360** in any other manner known in the art.

**[0032]** The exemplary embodiment may produce about eight (8) ounces (about 236.6 milliliters) of foam for an individual serving. The foam may be produced at

a rate of about 0.375 ounces/second (about 11 milliliters/second) by providing pressurized milk at about 0.375 ounces/second (about 11 milliliters/second) for about eight (8) seconds, pressurized air at about fifteen (15) psi (about one (1) ksc) for about eight (8) seconds, and pressurized steam at about fifteen (15) psi (about one (1) ksc) for about eight (8) seconds into the mixing area 310. The temperature of the milk may be about 155 degrees Fahrenheit (about 68.3 degrees Celsius) or so. The temperature of the nozzle body 240 may reach about 212 degrees Fahrenheit (about 100 degrees Celsius). The present invention is in no way limited to the exemplary embodiment and can be of any size, dimension, operating conditions, and flow rates necessary for the desired foam production.

[0033] The foamed milk system 100 also may be used to produce steamed milk for lattes and other hot beverages. The foamed milk system 100 may be used in substantially the same manner to produce steamed milk as it is used to produce foamed milk. Steamed milk may be produced by only introducing milk and steam into the foamed milk system 100. Thus, the pressurized air inlet system 160 would not be used. Milk from the pressurized milk inlet system 110 and steam from the pressurized steam inlet system 235 may be introduced to the mixing area 310, expanded in the expansion area 340, collected with the diffuser 350, and dispensed into the mug or cup 380 to produce the steamed milk desired. The present embodiment may pressurize the milk to about fifteen (15) psi (about 1 ksc) and the steam to about forty (40) psi (about 2.8 ksc) to produce steamed milk at a rate of about six (6) ounces per second (about 177.4 milliliters per second). Any pressure, however, may be used to accommodate a similar or different steamed milk production rate.

[0034] The foamed milk system 100 also may include a sanitation system 500. The sanitation system 500 may include a source of hot water 510. The hot water supply 510 may be the hot water storage tank of a coffee brewer (not shown) or a similar type of device. The hot water supply 510 may be connected to the air hose 180 via a hot water hose 520. A sanitation valve 530 may open and shut the hot water hose 520. The sanitation valve 530 may be a solenoid valve or a similar type of device. A T-joint 540 or a similar type of device may join the air hose 180 and the hot water hose 520. One or more check valves 550 may be placed on either side of the T-joint 540 to prevent backflow.

[0035] In order to flush the milk system 100, the sanitation valve 530 is opened and allows hot water to flow from the hot water source 510 through the hot water hose 520 and the check valves 550. The hot water is delivered to the hose connector 185, the mixture hose 220, and the nozzle body 240. A sufficient quantity of water is delivered to ensure that all internal surfaces reach a temperature of at least about 190 degrees Fahrenheit (about 87.8 degrees Celsius). This flush cycle ensures that all elements outside of the refrigerated container 155 or in connection with a non-refrigerated element are

flushed and sanitized. The flush cycle preferably is repeated about every two (2) hours or so.

[0036] Sanitation is further improved by the milk hoses 140, 150 and the mixture hose 220 being disposable. As such, the hoses 140, 150, 220 may be replaced daily. Likewise, the hose connector 185 and the nozzle insert 300 of the nozzle body 240 may be removed and sanitized each day. Further, the connectors used herein may be barbed to prevent crevice build up. The milk system 100 thus provides for quick and easy cleaning and sanitation.

[0037] Alternatively, the foamed milk system 100 also may include a cleaning block junction 390 depicted in Fig. 4. The cleaning block junction 390 may replace the hose connector 185. The cleaning block junction 390 may contain four (4) hose fittings 400, 410, 420, 430. The first three (3) fittings 400, 410, 420 may be connected to the milk hose 150, the air hose 180, and the mixture hose 220 in the manner described above with respect to the hose connector 185. The fourth fitting 430 may be connected to a flush water hose (not shown). Hot water may be forced through the flush water hose and into the cleaning block junction 390 to sterilize the foamed milk system 100. The hot water may travel through the mixture hose 220, the mixture inlet 230, the mixing area 310, the expansion area 340, and the diffuser 350 to sterilize the foamed milk system 100 as is described above. The system 100 as a whole may then be reoriented to producing the steamed milk and foam as is described above.

## Claims

1. A foamed milk system for creating foamed milk from a source of milk, a source of air, and a source of steam, comprising:

a milk inlet system (110) for pressurizing the milk;  
an air inlet system (160) for pressurizing the air;  
a mixing area (310) to mix the pressurized milk, the pressurized air, and the steam; and  
an expansion area (340) to expand the mixture of the pressurized milk, the pressurized air and the steam;

characterised in that said mixing area comprises an annular region formed between an inner wall of a hollow nozzle block (240) and a nozzle insert (300) positioned within the hollow nozzle block (240).

2. The foamed milk system of claim 1, wherein said milk inlet system (110) comprises a peristaltic pump (130).
3. The foamed milk system of claim 2, wherein said milk inlet system (110) comprises a disposable hose (140) connecting the source of milk and said peri-

staltic pump (130).

4. The foamed milk system of claim 1, 2 or 3, wherein the air inlet system (160) comprises an air pump (170).
5. The foamed milk system of any preceding claim, further comprising a hose connector (185) connecting said milk inlet system (110) and said air inlet system (160).
6. The foamed milk system of claim 5, wherein said hose connector (185) comprises a three-way valve.
7. The foamed milk system of claim 5, wherein said hose connector (185) comprises a four-way valve.
8. The foamed milk system of claim 3, wherein said disposable hose (140) comprises one or more check valves positioned therein. -
9. The foamed milk system of claim 5, 6 or 7, further comprising a disposable hose (220) connecting said hose connector (185) and said mixing area (310).
10. The foamed milk system of any preceding claim, wherein said nozzle insert (300) comprises a plurality of protrusions (320) positioned thereon.
11. The foamed milk system of claim 10, wherein said nozzle insert (300) comprises a plurality of orifice area positioned about said plurality of protrusions (320).
12. The foamed milk system of any preceding claim, wherein said nozzle insert (300) comprises a removable nozzle.
13. The foamed milk system of any preceding claim, further comprising a diffuser (350) to gather the flow of the foamed milk to be dispensed.
14. The foamed milk system of any preceding claim, further comprising a sanitation system (500).
15. The foamed milk system of claim 14, wherein said sanitation system (500) comprises a sanitation valve (530) adjacent to a source of hot water so as to provide hot water to said mixing area (310) and said expansion area (340).
16. A foamed milk system as claimed in any preceding claim, wherein:
 

the milk inlet system (110) is suitable to inject the pressurized milk into the said mixing area (310);

a steam inlet system (290) is suitable to inject

the steam into said mixing area; and  
the expansion area (340) is suitable to form a flow of steamed milk.

17. A method for producing foamed milk from milk, air, and steam, comprising:

pressurizing the milk and the air,  
injecting the pressurized milk, the pressurized air, and the steam into a mixing area (310); and  
depressurizing the milk, air, and steam mixture to ambient pressure to create the foamed milk;

**characterised in that** the mixing area comprises an annular region formed between an inner wall of a hollow nozzle block (240) and a nozzle insert (300) positioned within a hollow nozzle block (240).

## Patentansprüche

1. Schaummilchsystem zur Erzeugung von aufgeschäumter Milch von einer Quelle von Milch, einer Quelle von Luft und einer Quelle von Dampf, umfassend:

ein Milcheinlasssystem (110) zur Druckbeaufschlagung der Milch;  
ein Lufteinlasssystem (160) zur Druckbeaufschlagung der Luft;  
einen Mischbereich (310) zum Mischen der mit Druck beaufschlagten Milch, der mit Druck beaufschlagten Luft und des Dampfes; und  
einen Expansionsbereich (340), um die Mischung aus der mit Druck beaufschlagten Milch, der mit Druck beaufschlagten Luft und dem Dampf zu expandieren;

**dadurch gekennzeichnet, dass** der Mischbereich ein ringförmiges Gebiet umfasst, das zwischen einer Innenwand eines hohlen Düsenblocks (240) und einem Düseneinsatz (300) gebildet ist, der in dem hohlen Düsenblock (240) positioniert ist.

2. Schaummilchsystem nach Anspruch 1, bei dem das Milcheinlasssystem (110) eine peristaltische Pumpe (130) umfasst.
3. Schaummilchsystem nach Anspruch 2, bei dem das Milcheinlasssystem (110) einen Wegwerf Schlauch (140) umfasst, der die Quelle von Milch und die peristaltische Pumpe (130) verbindet.
4. Schaummilchsystem nach Anspruch 1, 2 oder 3, bei dem das Lufteinlasssystem (160) eine Luftpumpe (170) umfasst.
5. Schaummilchsystem nach einem vorangehenden

Anspruch, weiter umfassend einen Schlauchverbinder (185), der das Milcheinlasssystem (110) und das Lufteinlasssystem (160) verbindet.

6. Schaummilchsystem nach Anspruch 5, bei dem der Schlauchverbinder (185) ein Dreiwegeventil umfasst.
7. Schaummilchsystem nach Anspruch 5, bei dem der Schlauchverbinder (185) ein Vierwegeventil umfasst.
8. Schaummilchsystem nach Anspruch 3, bei dem der Wegwerfeschlauch (140) einen oder mehrere darin positionierte Rückschlagventile umfasst.
9. Schaummilchsystem nach Anspruch 5, 6 oder 7, weiter umfassend einen Wegwerfeschlauch (220), der den Schlauchverbinder (185) und den Mischbereich (310) verbindet.
10. Schaummilchsystem nach einem vorangehenden Anspruch, bei dem der Düseneinsatz (300) eine Mehrzahl von darauf positionierten Vorsprüngen (320) umfasst.
11. Schaummilchsystem nach Anspruch 10, bei dem der Düseneinsatz (300) eine Mehrzahl von Öffnungsbereichen umfasst, die um die Mehrzahl von Vorsprüngen (320) positioniert sind.
12. Schaummilchsystem nach einem vorangehenden Anspruch, bei dem der Düseneinsatz (300) eine entfernbare Düse umfasst.
13. Schaummilchsystem nach einem vorangehenden Anspruch, weiter umfassend einen Diffusor (350), um den Strom der abzugebenden aufgeschäumten Milch zu sammeln.
14. Schaummilchsystem nach einem vorangehenden Anspruch, weiter umfassend ein Hygienesystem (500).
15. Schaummilchsystem nach Anspruch 14, bei dem das Hygienesystem (500) ein zu einer Quelle von Heißwasser benachbartes Hygieneventil (530) umfasst, um Heißwasser zu dem Mischbereich (310) und dem Expansionsbereich (340) zuzuführen.
16. Schaummilchsystem nach einem vorangehenden Anspruch, bei dem:

das Milcheinlasssystem (110) geeignet ist, um die mit Druck beaufschlagte Milch in den Mischbereich (310) einzuspritzen;  
ein Dampfeinlasssystem (290) geeignet ist, um den Dampf in den Mischbereich einzuspritzen;

und  
der Expansionsbereich (340) geeignet ist, um einen Strom von Milchschaum zu bilden.

- 5 17. Verfahren zur Erzeugung von aufgeschäumter Milch aus Milch, Luft und Dampf, umfassend:

Druckbeaufschlagen der Milch und der Luft, Einspritzen der mit Druck beaufschlagten Milch, der mit Druck beaufschlagten Luft und des Dampfes in einen Mischbereich (310); und Druckentlasten der Mischung aus Milch, Luft und Dampf auf Umgebungsdruck, um die aufgeschäumte Milch zu erzeugen;

**dadurch gekennzeichnet, dass** der Mischbereich ein ringförmiges Gebiet umfasst, das zwischen einer Innenwand eines hohlen Düsenblocks (240) und einem in einem hohlen Düsenblock (240) positionierten Düseneinsatz (300) gebildet ist.

#### Revendications

- 25 1. Système de lait en mousse pour créer du lait en mousse à partir d'une source de lait, une source d'air et une source de vapeur, comprenant :

un système d'entrée de lait (110) pour mettre le lait sous pression ;  
un système d'entrée d'air (160) pour mettre l'air sous pression ;  
une zone de mélange (310) pour mélanger le lait sous pression, l'air sous pression et la vapeur ; et  
une zone de dilatation (340) pour dilater le mélange de lait sous pression, d'air sous pression et de vapeur ;

40 **caractérisé en ce que** ladite zone de mélange comprend une région annulaire formée entre une paroi interne et un bloc de buse creuse (240) et un insert de buse (300) positionné à l'intérieur du bloc de buse creuse (240) ;

2. Système de lait en mousse selon la revendication 1, dans lequel ledit système d'entrée de lait (110) comprend une pompe péristaltique (130).

- 50 3. Système de lait en mousse selon la revendication 2, dans lequel ledit système d'entrée de lait (110) comprend un flexible jetable (140) raccordant la source de lait et ladite pompe péristaltique (130).

- 55 4. Système de lait en mousse selon la revendication 1, 2 ou 3, dans lequel le système d'entrée d'air (160) comprend une pompe à air (170).

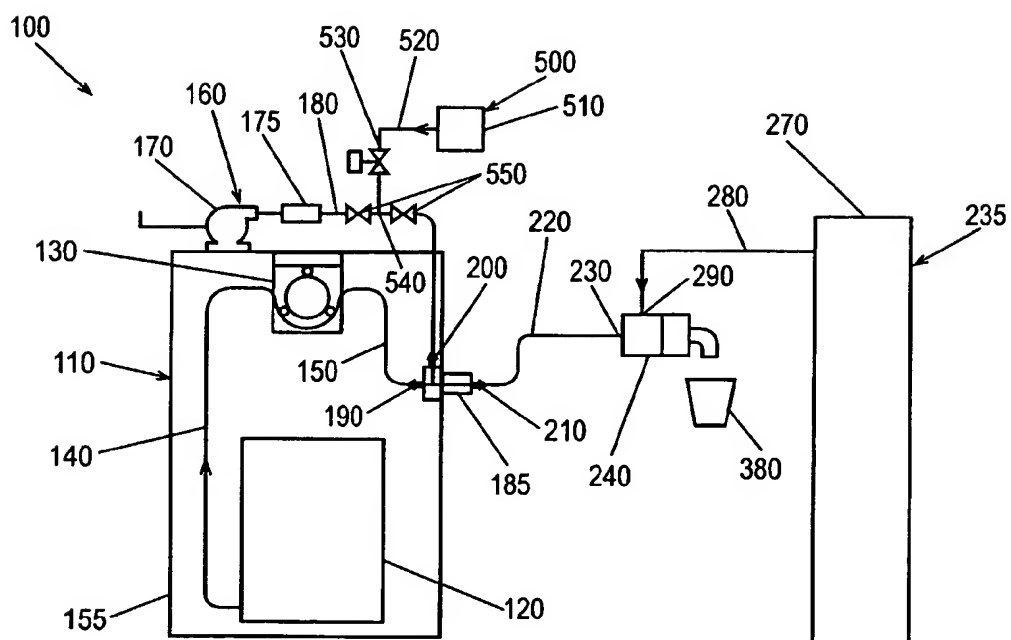
5. Système de lait en mousse selon l'une quelconque des revendications précédentes, comprenant en outre un connecteur de flexible (185) raccordant ledit système d'entrée de lait (110) et ledit système d'entrée d'air (160). 5
 

pour injecter le lait sous pression dans ladite zone de mélange (310) ;  
un système d'entrée de vapeur (290) est approprié pour injecter la vapeur dans ladite zone de mélange ; et  
la zone de dilatation (340) est appropriée pour former un écoulement de lait traité à la vapeur.
6. Système de lait en mousse selon la revendication 5, dans lequel ledit connecteur de flexible (185) comprend une soupape à trois voies. 10
7. Système de lait en mousse selon la revendication 5, dans lequel ledit connecteur de flexible (185) comprend une soupape à quatre voies. 10
8. Système de lait en mousse selon la revendication 3, dans lequel ledit flexible jetable (140) comprend une ou plusieurs soupapes anti-retour positionnées à l'intérieur de celui-ci. 15
9. Système de lait en mousse selon la revendication 5, 6 ou 7, comprenant en outre un flexible jetable (220) raccordant ledit connecteur de flexible (185) et ladite zone de mélange (310). 20
10. Système de lait en mousse selon l'une quelconque des revendications précédentes, dans lequel ledit insert de buse (300) comprend une pluralité de saillies (320) positionnées sur celui-ci. 25
11. Système de lait en mousse selon la revendication 10, dans lequel ledit insert de buse (300) comprend une pluralité de surfaces d'orifice positionnées autour de ladite pluralité de saillies (320). 30
12. Système de lait en mousse selon l'une quelconque des revendications précédentes, dans lequel ledit insert de buse (300) comprend une buse amovible. 35
13. Système de lait en mousse selon l'une quelconque des revendications précédentes, comprenant en outre un diffuseur (350) pour recueillir l'écoulement de lait en mousse à distribuer. 40
14. Système de lait en mousse selon l'une quelconque des revendications précédentes, comprenant en outre un système sanitaire (500). 45
15. Système de lait en mousse selon la revendication 14, dans lequel ledit système sanitaire (500) comprend une soupape sanitaire (530) adjacente à une source d'eau chaude afin d'introduire l'eau chaude dans ladite zone de mélange (310) et ladite zone de dilatation (340). 50
16. Système de lait en mousse selon l'une quelconque des revendications précédentes, dans lequel : 55
 

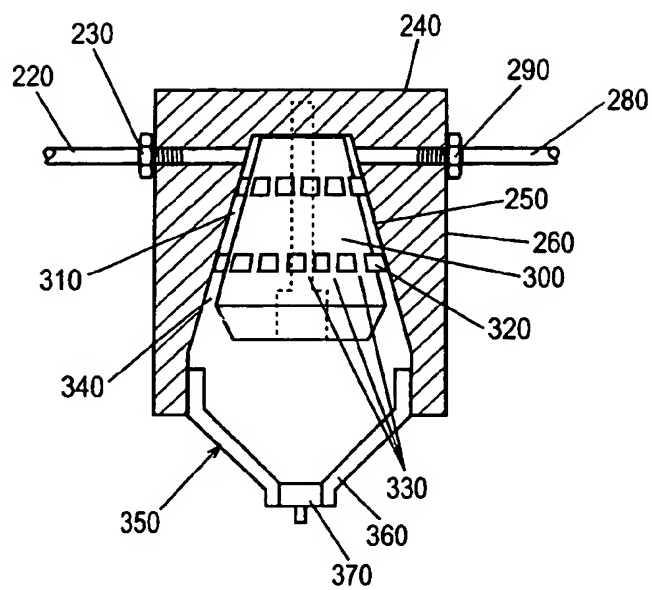
le système d'entrée de lait (110) est approprié
17. Procédé pour produire du lait en mousse à partir de lait, d'air et de vapeur, comprenant les étapes consistant à:
 

mettre le lait et l'air sous pression,  
injecter le lait sous pression, l'air sous pression et la vapeur dans une zone de mélange (310); et  
dépressuriser le mélange de lait, d'air et de vapeur à la pression ambiante pour créer le lait en mousse;

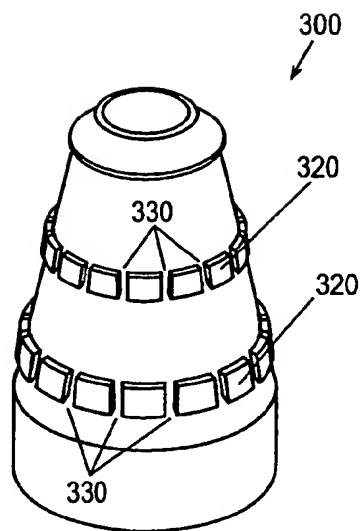
**caractérisé en ce que** la zone de mélange comprend une région annulaire formée entre une paroi interne d'un bloc de buse creuse (240) et un insert de buse (300) positionné à l'intérieur d'un bloc de buse creuse (240).



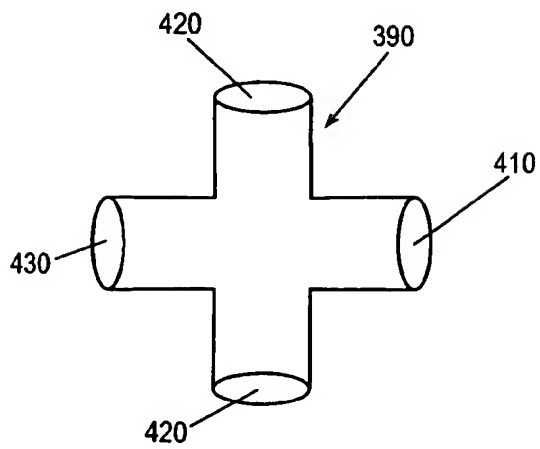
*Fig. 1*



**Fig. 2**



**Fig. 3**



**Fig. 4**